

I. F. P - U. S. G. S

RAPPORT DE TRAITEMENT D'UNE ETUDE
DE SISMIQUE MARINE FLEXICHOC

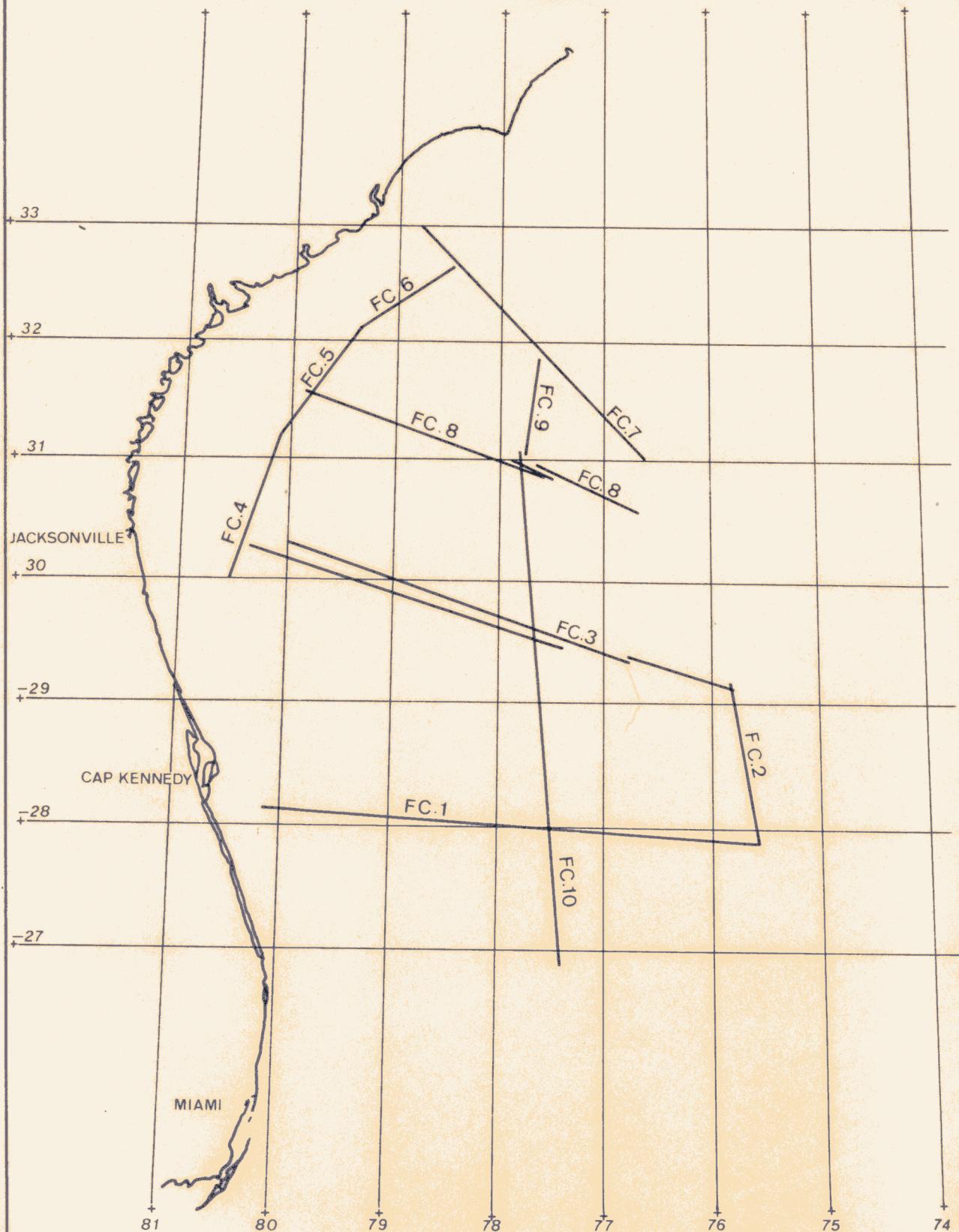
Mars - Septembre 1975

Septembre 1975

IFP USGS

BLAKE PLATEAU

FIG: 1



INTRODUCTION

Le présent rapport rend compte du traitement d'une campagne sismique océanographique Flexichoc, exécutée par l'Institut Français du Pétrole, au large des côtes de Floride, dans la région du BLAKE PLATEAU, entre 27° et 33° de latitude Nord, et entre 75° et 81° de longitude Ouest (fig. 1)

Ce traitement a été effectué au centre de C.G.G. MASSY, pour le compte de l'I.F.P. et de l'U.S.G.C, en application de la lettre d'accord IT-ER/MC n° 431 du 17 Février 1975 adressée à l'Institut Français du Pétrole par la Compagnie Générale de Géophysique.

CHAPITRE IGENERALITESI.1 - Exploitation terrain

Bateau : FLORANCE
 Enregistreur : SN 338
 Streamer : 2400 m - 48 traces - 50 m entre traces
 Pas d'échantillonnage : 4 ms
 Couverture : 2400 %
 Source d'énergie : Flexichoc

I.2 - Données historiques et statistiquesAA - Date d'arrivée des bandes au central

Première réception : 20 Février 1975

Profils FC I	PT 1 à PT 8714
FC II	PT 1 à PT 2695
FC III	PT 1 à PT 2100
FC IV	PT 1 à PT 2680
FC V	PT 1 à PT 2933
FC VI	PT 1 à PT 2453
FC VII	PT 1 à PT 5509
FC VIII	PT 1 à PT 1942

Deuxième réception : 16 Juin 1975

Profil FC III	PT 1 à 6390
Profil FC VIII	PT 1 à 849
Profil FC VIIIIA	PT 1 à 4361
Profil FC IX	PT 1 à 1992
Profil FC X	PT 1 à 8839

BB - Remise section

Première réception : première section livrée le 28 Mars 1975
 dernière section livrée le 30 Avril 1975

Deuxième réception : première section livrée le 15 Juil. 1975
 dernière section livrée le 25 Août 1975

CC - Statistiques

Nombre de points de tirs reçus :

- première réception : 29026

- deuxième réception : 22431

soit au total 51457 PT représentant 2572,850 km.

Nombre de points de tirs traités :

- première réception : 28908

- deuxième réception : 22209

soit au total 51117 PT représentant 2555,850 km.

I.3 - Caractéristiques du traitement appliqué

Le traitement retenu a été du P2/P4, c'est-à-dire :

- 1 analyse de vitesses pour 10,000 km
- Addition sans déconvolution pour l'ensemble de l'étude
- Addition supplémentaire avec déconvolution avant stack pour les zones du plateau à profondeur d'eau inférieure à 400 - 500 ms.

Ordre de couverture 2400 /

Longueur du traitement : 4,5 à 6 secondes sous le fond

Pas d'échantillonnage : 4 ms.

CHAPITRE II

Choix des paramètres de traitement

II.1 - Mute

Des simples couvertures non mutées mais corrigées dynamiquement, établies pour différentes profondeurs d'eau, ont permis de choisir deux lois de mute : l'une pour la zone des hauts fonds, l'autre pour la profondeur d'eau maximum de l'étude.

Sur la base de ces deux lois, une interpolation a été faite en fonction des profondeurs d'eau.

Aucune suite n'a été donnée à un essai de mute plus sévère.

II.2 - Déconvolution

Par suite de la remarquable horizontalité des séries sédimentaires visible sur les sections de bord, les essais préliminaires ont porté plus particulièrement sur la recherche des meilleurs paramètres de déconvolution.

Une première série de tests a été réalisée sur des zones à tranches d'eau différentes.

Fond à 0sec : profil FC V PT 500 à PT 1000 (Planches 1, 2, 3)

Fond à 1sec : profil FC I PT 3360 à PT 3800 (Planches 4, 5, 6)

Fond à 6sec : profil FC I PT 7900 à PT 8100 (Planche 7)

Trois sorties ont été mises en comparaison : la première, sans déconvolution, la seconde, avec une déconvolution avant addition, la troisième, avec une déconvolution après addition, chacune de ces déconvolutions ayant une longueur d'opérateur de 240 ms et deux fenêtres de calcul.

L'examen de ces différentes sorties a montré que, dans ce cas, si l'application d'une déconvolution supprime les rebondissements de phase et donne du caractère aux différents horizons, elle diminue de façon sensible l'énergie des réflexions.

Une seconde série de tests portant sur la recherche des meilleures fenêtres de calcul d'une déconvolution avant addition, a été effectuée sur 60 tirs dans une zone à 1 seconde de profondeur d'eau - Profil FC I : PT 3360 à PT 3420-, et sur 60 tirs dans une zone à 6 secondes de profondeur d'eau - Profil FC I : PT 7900 à PT 7960.

Les résultats de cette recherche réalisée en utilisant un opérateur de 240 ms et en appliquant 3 lois de mute différentes (le mute 1 ne conservant que 2 traces au fond de l'eau), sont présentés sur la planche 8.

Une troisième série de tests a été faite sur 50 tirs dans une zone à fond nul - Profil FC V : PT 795 à PT 846 - (Pl. 9). Ces tests ont consisté à appliquer 3 longueurs d'opérateur différentes ($L = 60, 120$ et 180 ms) et à présenter les auto-correlations correspondantes.

Enfin, dans le but de donner une meilleure définition aux horizons, après l'application d'une déconvolution, un essai d'amélioration de la cohérence a été effectué sur une sortie avec déconvolution avant addition - Profil FC V : PT 767 à 930 (Planche 10).
(Conjointement à ce test, un essai de représentation analogique a été fait : aire variable seule et aire variable + galva)

La synthèse de ces différents tests a conduit à adopter les traitements suivants :

Zones de 0 à 500 ms environ de profondeur d'eau :

- a) sortie sans déconvolution
- b) sortie avec déconvolution avant addition
- c) sortie avec déconvolution avant addition et application du programme d'Amélioration de la Cohérence Spatiale (AMCO-D) après addition filtrée.

Paramètres de déconvolution choisis :

2 fenêtres de calcul : 200 à 1600 ms } origine suivant le fond
 1200 à 3000 ms } de la mer

Longueur de l'opérateur : 240 ms

Zones à profondeur d'eau supérieure à 500 ms

Une seule sortie : addition sans déconvolution.

III.3 - Vitesses

Prévue par la lettre d'accord, la densité d'une analyse de vitesses pour 10,800 km a été suffisante pour l'ensemble de l'étude.

Le pointé de ces analyses n'a pas présenté de difficultés particulières.

Toutefois, certains profils ayant montré des événements sous la discordance profonde (3 secondes), des analyses supplémentaires ont été réalisées sur 3 portions de profils - FC IV : PT 1001 à PT 1051 et PT 1041 à PT 2441 - FC VII : PT 2301 à 2451-, soit 26 analyses supplémentaires.

Appuyée par ces analyses supplémentaires, une nouvelle détermination des vitesses a permis d'améliorer de façon sensible, la portion du profil FC VII comprise entre les PT 2095 et 2488.

III.4 - Filtrage

Des essais de filtres ont été effectués sur des zones à différentes profondeurs d'eau.

Fond à 0sec : profil FC V PT 667 à PT 626 (Planche 11)

Fond à 1sec : profil FC I PT 2360 à PT 2420 (Planche 12)

Fond à 6sec : profil FC I PT 7900 à PT 7959 (Planche 13)

Dans la zone à hauts-fonds, trois filtres ont alors été choisis :

<u>Filtre I</u>	:	0 à 300 ms	13.5/50	Hertz
		1200 à 1500 ms	10/50	Hertz
		2000 à 2300 ms	10/43	Hertz
		3000 à 3300 ms	12.5/37	Hertz
		4400 à 6000 ms	12.5/30	Hertz
<u>Filtre II</u>	:	0 à 1300 ms	11/45	Hertz
		3000 à 6000 ms	13.5/30	Hertz
<u>Filtre III</u>	:	filtre passe-bande	6/60	Hertz

Ces filtres ont été testés sur le profil FC V PT 500 à PT 1000.

Filtre I - Planche 14

Filtre II - Planche 15

Filtre III - Planche 16

L'examen de ces différents essais a conduit à choisir le système de filtres suivants :

Zones hautes et moyennes (fond inférieur 2000 ms)

Intervalle de 800 ms,

à partir du fond de la mer : 13/48 Hertz

Intervalle de 900 ms : interpolation

Intervalle de 300 ms : 13/43 Hertz

Intervalle de 1400 ms : interpolation

Intervalle de 2600 ms : 13⁵/30 Hertz

Zones profondes (fond compris entre 5000 et 6000 ms)

Intervalle de 300 ms :

à partir du fond de la mer : 13⁵/50 Hertz

Intervalle de 1000 ms : interpolation

Intervalle de 500 ms : 12⁵/50 Hertz

Intervalle de 2000 ms : interpolation

Intervalle de 2200 ms : 13⁵/32 Hertz

Pour les zones dont le fond est compris entre 2 secondes et 5 secondes, il y a eu interpolation entre les deux filtres définis ci-dessus.

CHAPITRE III

Traitemen^t Appliqu^é

Le traitement de routine résumé sur toutes les tétières d'habillage des sections a été le suivant :

III.1 - Traitement initial

Transferts :

- Entrée, démultiplexage des enregistrements
- Elimination des tirs défectueux
- Mise en collection - couverture 2400 %
- Sortie intermédiaire sur bande séquentielle 7 pistes 800 BPI
- Rejet au TNR 91 des collections des traces 1 de tous les profils pour vérifier les opérations de transfert.

Pré-traitement :

- Entrée de la mise en collection
- Récupération des amplitudes
- Mute
- Déconvolution SILENE 2 fenêtres pour les zones à fond inférieur à 500 ms avec les paramètres définis au § II.2
- Analyse de vitesses ANVIT : 96 traces entrées soit 4 CDP consécutifs. (densité 1 ANVIT tous les 10,8 km de profil)
- Rejet analogique sur GOULD comportant les valeurs chiffrées des vitesses correspondant aux deux plus forts poids des ANVIT à un temps donné.

III.2 - Préparation intermédiaire

- Choix du mute
- Interprétation des ANVIT profil par profil
- Choix du filtrage variable

III.3 - Traitemen t final

- Entrée de la mise en collection
- Récupération des amplitudes
- Mute
- Déconvolution SILENE 2 fenêtres pour les zones à fond inférieur à 500 ms avec les paramètres définis au § II.2.
- Addition couverture 2400 %
- Filtrage variable
- Application du programme d'Amélioration de la Cohérence Spatiale (AMCO-D) pour les zones à fond inférieur à 500 ms.
- Egalisation dynamique des traces
- Rejet analogique au TNR 91 sans filtre en aire variable des différentes sorties

Echelles : verticale : 5 cm = 1 seconde temps double
horizontale = 1/25 000

Pour permettre une meilleure vue d'ensemble et pour accentuer les pendages, un nouveau rejet analogique de la totalité de l'étude a été fait en fin de traitement.

Echelles : verticale : 5 cm = 1 seconde temps double
horizontale = 1/100 000 avec rejet d'un CDP sur deux

Pour les profils présentés sous trois versions, seule la sortie déconvoluée avec application du programme AMCO-D a été réduite.

ANNEX

C.G.G

DIGITAL PROCESSING SERVICES

and

INTERPRETATION

ENCLOSURE 1 : - Basic Marine Processing Packages and Options
Data Interpretation

ENCLOSURE 2 : - Short Description of Programs

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ENCLOSURE 1

1.1. BASIC MARINE PROCESSING PACKAGES

- P1 - Simple stacking with velocity informations supplied by the client
- P2 - Package with regularly and widely spaced velocity analyses
- P3 - Package P1 plus DBS
- P4 - Package P2 plus DBS
- P5 - Standard package with regularly spaced velocity analyses
- P5S - Standard package with continuous velocity analyses (ANVIT Program)
- P6 - Sophisticated package with :
 - Preliminary "brute" stack and display
 - Continuous velocity analyses (ANVIT Program)
 - Display of velocity horizons and interval velocities
- P7 - Package P6 with automatic velocity picking and display (MIVIT Program)
P5S, P6 and P7 allows further processing such as :
 - Velocity harmonization
 - Modelling through interactive system

PAM Package

- Processing with Preserved Amplitude Method (PAM)

WIDE LINE PROFILING (WLP* Package)

WIPER Package

- Attenuation of water bottom reverberation and peg leg multiples
This is a multichannel process which determines automatically the arrival time of water bottom and or peg leg multiples and attenuates them through an auto-adapted subtraction method.

MIGRATION Package

- Time depth conversion
- Migration with amplitude preservation (PAMIG)

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COMPAGNIE GÉNÉRALE DE GÉOPHYSIQUE

1.2. OPTIONS

1.2.1. Velocity analysis

- Conventional $V = f(T)$ analysis (ANVIT)
- ANVIT gathered velocity analysis (ANVIT - GATHER)
- Constant velocity scan (MINISCAN - VSCAN)
- Move-out scan (SOMIV)
- Constant Velocity Gather (CVG)
- Dip and velocity automatic determination (MIVIT)
- Velocity harmonization

1.2.2. Multiple attenuation

- Attenuation of water bottom reverberation (WIPER)
- Auto-adapted stack (ADAPT)
- Auto-adapted subtraction of multiple model (SOUSTON)
- Auto-adapted predictive deconvolution (TRITA)
- Phase adjusted stack

1.2.3. Coherency enhancement programs

- Multichannel coherency filter for horizontal events
- Multichannel coherency filter for dipping events
- Frequency and dip coherency process

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1.3. LAND DATA PROCESSING

1.3.1. Static corrections

- Using first break (DROMO)
- Automated residual static corrections analysis in area of easy surface conditions and good signal over noise ratio (FASTA)
- Automated residual static corrections analysis in area of rough surface conditions and poor signal over noise ratio (SATAN)

1.3.2. SLALOM LINE* Package for non linear spreads

- Possibility of shooting non linear lines on the field :
 - adjustment of shot point and geophone pattern distances (by using their field coordinates) before stacking
 - association to WLP* processing technics with transversal dip investigation

1.4. DATA INTERPRETATION

- Data interpretation, contouring, mapping with provision of :
 - isochron
 - isopach
 - isobath
 - velocity harmonization and mapping of DIX interval and average velocities of the selected horizons
 - interpretation report

The data interpretation could be carried out either at the CGG's main office of MASSY (FRANCE) or at the client's offices.

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ENCLOSURE 2

SHORT DESCRIPTION OF PROCESSING PROGRAMS

2.1. DECONVOLUTION

The deconvolution program can compute up to ten operators per trace, through a least square, Wiener Levinson type technique. Calculation windows may be positioned anywhere on the trace. They may have different lengths and different noise suppression factors. In addition, the operators may be applied to any portion of the trace as desired by the user, and merge zones from one operator to the next may also be specified by the user.

In case of Vibroseis source*, the desired output signal is a truncated auto-correlation of the pilot signal (sweep), resulting in a shaping rather than in a spiking operation.

Continuous interpolation in space allows the user to vary at his choice along the line any of the above parameters.

2.2. PREDICTIVE DECONVOLUTION (TRITA)

The TRITA program performs a predictive deconvolution through the use of gapped operators which are automatically adapted in amplitude inside a gate moving along the trace to compensate for relative amplitude distortions. The prediction period is automatically derived from the auto-correlation of the trace.

2.3. AUTO-ADAPTED SUBTRACTION OF MULTIPLES (SOUSTON)

A program to eliminate multiples. The principal is to produce a model in which the multiples are dominant. This model is subtracted from the individual traces by SOUSTON. The amplitudes of the model are automatically adjusted to permit the most effective subtraction.

2.4. AUTO-ADAPTED STACK

The auto-adapted stack program (ADAPT) starts by computing for each CDP a model trace which is the addition of all or certain traces of one or several successive CDP with the dip taken into account if necessary.

Then the program calculates the coherency between each input trace and the model trace, weights the trace by the coherency function, and finally adds the weighted traces.

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This process has shown considerable success in improving the overall signal to noise ratio in difficult areas, in controlling specific unwanted events such as repetitions, or in eliminating multiples having a residual NMO.

2.5. PHASE ADJUSTED STACK

The traces of a common depth point are compared and their respective shifts are found. Depending on the objective these shifts can be compensated for to improve the stack or can be used to better distinguish between real and multiples events.

The use of this method is justified when the travel paths of the traces belonging to the same CDP are significantly different for example in the proximity of salt domes or in marine data in area where the water depth changes rapidly or in area of contrasted velocity.

2.6. FREQUENCY AND DIP COHERENCY PROCESS

This automatic process of analyzing the frequencies in function of dips results in a great improvement of stacked data.

2.7. COHERENCY ENHANCEMENT

2.7.1. Amplitude multichannel coherency filter for horizontal events

2.7.2. Amplitude multichannel coherency filter for dipping events

Both programs are similar in many respects by computing the coherency between the current trace and one model only or several models.

This process is similar to the above ADAPT process, but applies to traces belonging to successive CDP. The program creates a model for each input trace, by adding together several traces located on each side of the input trace, taking the dip into account. The comparison between each trace and the corresponding model generates a coherency function which is used to weigh the input traces.

This results in a certain enhancement of the signal to noise ratio as well as in the application of space oriented rather than time oriented equalization coefficients.

2.8. TIME VARYING FILTER

It can include up to ten operators per trace, with continuous interpolation between operators in space as well as in time.

2.9. DYNAMIC EQUALIZATION

A dynamic equalization process may be applied to each trace before final output. The window size and lengths are at user's discretion as well as the desired average amplitude for each window.

2.10. VELOCITY CONTROL

Velocity control may be achieved through several approaches. In any case, all traces used for velocity determination are first edited and muted.

2.10.1. Velocity analysis : ANVIT Program

The ANVIT module allows the user to analyse the velocity of input traces. The program performs the following operations :

- Calculation of 24 different RMS velocity functions by addition of a specified delta T increment to a given reference function ;
- Application of the corresponding NMO corrections to traces belonging to a CDP and addition of those. This results in 24 stack traces, one for each velocity function ;
- Passage to absolute values, integration, and resampling to 25 ms of the stack traces. This gives a matrix of 24 columns (one per velocity function) and $T/25$ rows, where T is the time length of the velocity analysis ;
- If desired, addition of matrices corresponding to several successive CDP in order to improve the signal to noise ratio. The user may decide whether or not to take the dip into consideration when making the addition ;
- Formatting of the data for the selected outputs which may consist of :
 - computer printout and/or analog display of the results ;
 - output of the stack traces for further processing by the MIVIT module ;
 - output of the matrices for further processing by the ANVIR and/or ANVIL module.
- Also ANVIT can be obtained as a continuous velocity analysis.

2.10.2. ANVIT Gathered Velocity Analysis (ANVIT - GATHER)

By using this option the interpreter is supplied with the $V = f(T)$ results showing :

- the plotted reference velocity function
- the resulting CDP stack obtained by correcting with the selected reference velocity function.

2.10.3. Velocity scan (VSCAN - MINISCAN)

This technique consists of stacking a certain number of consecutive CDP (at least 24) with a set of constant velocities. Number of velocities, data length, (with zero time or non zero time origin), number of CDP are at user's discretion.

Velocity scans give a good visual check of the velocities, and may be run either in addition to or in place of velocity analyses. They are especially useful in very poor signal to noise ratio situations.

Continuous velocity scans are advisable in areas of fast velocity variations, strong dips or poor data quality.

2.10.4. Move-out scan (SOMIV)

This program produces a "Move-out scan", i.e. a $\Delta T - T$ scan using intermediate ANVIT outputs (which can also be input to MIVIT).

The interpreter is supplied with a Gould display of the velocity functions. The reference velocity function 0 is plotted using a thicker line. Functions > 0 are faster than the reference function and those < 0 are slower. In subsequent calls SOMIV arranges the data in the same way as VSCAN and produces a certain number of CDP stacked with the reference velocity function (0) and the selected negative or positive functions.

2.10.5. MIVIT Module

The program performs automatic picking operations by computing the coherency of input data versus both dip and velocity.

For each selected picking the program outputs :

- Time, Dip, average velocity, amplitude, dominant frequency and quality parameter.

The interpreter is supplied with 3 types of displays :

- Display of the vectors with the average vertical DIX velocity ;
- Display of the velocity values according to a time versus velocity diagram ;
- Display of the velocity horizons.

2.11. PRESERVED AMPLITUDE METHOD (PAM)

The first step, immediately after demultiplexing the field data consists of recovering the true amplitude of the seismic signal. This is done by multiplying each sample by its own gain.

The objective of preserved amplitude processing is to supply the interpreter with a section where variations of amplitude can be related quantitatively to variations of reflection coefficients.

After true amplitude recovery the data are converted to floating point if they were not originally in that format and stored.

After application of the two series of compensation factors (amplitude decay analysis and compensation for surface dependent factors) the data are processed in a conventional manner.

One good technique consists of doing both processing (conventional and PAM package) at the same time providing PAM package has been selected prior to demultiplexing stage.

2.12. MODELLING PACKAGE

The initial procedure consists of performing a continuous velocity analyses and of obtaining time horizons, velocity horizons and migrated depth section using the resulting velocity distribution. The interpreter uses this migrated depth section to construct a first model taking into account the structural features and the velocity distribution. Then the program computes the theoretical time section and seismic velocities corresponding to this model. Values of velocities and depths are then adapted by iteration until theoretical time and velocities horizons are in agreement with the original ones.

This package is particularly suitable for helping interpretation in saliferous tectonics or in area of steep dips and large velocity contrast. It is also a useful tool for interpreting narrow velocity anomalies such as reefs (for instance to delineate their edges).

2.13. PRESERVED AMPLITUDE MIGRATION (PAMIG Program)

In standard programs for migration in time, each migrated sample is obtained by adding together all of the samples in the section to be migrated to that point. Almost all of these samples will lie on a diffraction hyperbola whose highest point coincides with the migrated sample.

PAMIG, instead of adding together all of the samples lying on a diffraction hyperbola, will take only one sample - the sample whose dip, measured over a few traces, is nearest to that of the hyperbola.

This has the following advantages :

- no signal deformation resulting from the addition,
- no artificial lengthening of strong arrivals,
- increased computation speed.

2.14. WIDE LINE PROFILING (WLP*) Package

It is a three dimensional seismic field and processing technique.

"Wide Line Profiling" consists of distributing an adequate number of shot points and receivers in such a way that we obtain a kind of strip of the reflectors on which the reflecting points are regularly spaced out. Generally, the strip consists of 3 to 6 parallel lines covering a total width of a few hundred meters.

When processing the sections, an extremely rigorous selection procedure is applied, so that only the events with a lateral time gradient which falls inside a narrow window of a few milliseconds by 100 meters are retained. Depending on the complexity of the tectonics, 5 to 11 selections are made, to ensure that the whole range of expected reflections is covered.

All the events which are retained can then be grouped together on a single section to make the interpretation easier. This single section has a higher signal/noise ratio than the section obtained by recording a conventional profile, for two reasons :

- firstly, only the events with lateral coherence are retained, thus helping to eliminate random noise ;
- secondly, only the events with a lateral time gradient which is compatible with local tectonics are retained, eliminating thus organised lateral noises, which generally have a stronger gradient.

Furthermore, the accurate lateral, longitudinal and total gradients of all the events retained are calculated by a computer. The result is printed every 200 ms and every 6 traces on a document which can be superimposed on the section.

When used in conjunction with automatic picking (MIVIT processing) or hand picking, which selects the seismic horizons, "WLP" processing supplies all the information necessary to trace the isochron map of the main horizons in receiver position or in migrated position. The accuracy of this tracing is of course very much improved since the direction of the true dip is known.

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2.15. LAND DATA PROCESSING

2.15.1. Automatic Static Correction Analysis (SATAN Program)

When we apply a static correction to a certain shot point, all traces recorded from that shot point are shifted by an amount equal to the static correction. Similarly when we apply a static correction to a geophone station, all traces recorded from that station are shifted accordingly.

The program applies different static corrections to each shot point or geophone station, and, for each correction, computes the value of a function that is representative of the quality of the correction. The same operation is then repeated for every shot point and geophone station.

Since the corrections are somewhat interrelated, several iterations are necessary to obtain the final values. Consequently, many operations must be completed before finding each correction, and the total processing time is relatively high.

The program can process "SLALOM LINE" * and "WIDE LINE PROFILING" * lines (WLP).

Depending on the user's decision, the program may either apply the corrections to the input records and perform the stack, or simply print out the results.

This program is particularly suitable in area of rough surface conditions and poor signal over noise ratio.

2.15.2. SLALOM LINE* PACKAGE

Recently developed by CGG this package allows the processing of crooked or non linear lines.

The processing consists of two runs after inputting the field parameters. The initial procedure is to display, the geophone and shot point patterns according to their field coordinates as well as the resulting CDP.

An automatic selection of the properly ordered CDP within a fixed window allows to stack the data either with or without transversal dip investigation in reference with the WLP* processing technics.

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MARINE BASIC PROCESSING PACKAGES

P1

Phase 1

- Demultiplexing, Editing
- True amplitude recovery (1)
- Vertical summing of adjacent records (if applicable)
- Application of individual gain recovery function
- CDP gathers
- Vaporchoc (*) signal recovery (if applicable)

Phase 2

- Muting
- Normal move out corrections (4)
- Stacking
- SILENE time varying deconvolution (optional)
- Predictive deconvolution TRITA (optional)
- Time variant filtering
- Dynamic equalization
- Digital output
- Film display of final stack and 3 prints (3)

P3

- Same as P1 + DBS

(4) P1, P3 : Velocities for NMO corrections are supplied by client

- (1) An option allows amplitude and gain preservation for further optional processing in Preserved Amplitude Method (PAM Package)
- (2) Other velocity analysis combination possible and available
- (3) Maximum horizontal scale : 2 mm between traces
Maximum vertical scale : 15 cm for 1 second t.w.t
Other scaling combination available

* Gould paper display and one copy supplied

P2

Phase 1

- Demultiplexing, Editing
- True amplitude recovery (1)
- Vertical summing of adjacent records (if applicable)
- Application of individual gain recovery function
- CDP gathers
- Vaporchoc (*) signal recovery (if applicable)

Phase 2

- Velocity analyses with ANVIT Program *
 - one analysis every 10.800 kilometers (2)
- Velocity analysis interpretation

Phase 3

- NMO corrections and first break muting
- Stack
 - May be replaced as an option by either a coherency adapted stack or a phase adjustment stack
- SILENE time varying deconvolution (optional)
- Predictive deconvolution TRITA (optional)
- Time varying filter
- Dynamic trace equalization
- Film display and 3 prints supplied
 - Maximum horizontal scale : 2 mm between trace (3)
 - Maximum vertical scale : 15 cm for 1 second t.w.t (3)

P4

- Same as P2 + DBS

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COMPAGNIE GÉNÉRALE DE GÉOPHYSIQUE

MARINE BASIC PROCESSING PACKAGE

Conventional P5 Package

Phase 1

- Demultiplexing, Editing
- True amplitude recovery (1)
- Vertical summing of adjacent records (if applicable)
- Application of individual gain recovery function
- CDP gathers
- Vaporchoc (*) signal recovery (if applicable)
- SILENE time varying deconvolution

Phase 2

- Velocity analysis with :
 - ANVIT Program every 3.600 km (2) * or
 - Constant velocity gather (CVG - 12 velocities) every 3.600 km (2) ** or
 - Constant velocity stack (VSCAN - 12 velocities) every 10.800 km (2) ***

Phase 3

- NMO corrections and first break muting
- Stack
 - May be replaced as an option by either a coherency adapted stack or a phase adjusted stack
- SILENE time varying deconvolution (optional)
- Predictive deconvolution TRITA (optional)
- Time varying filter
- Dynamic trace equalization
- Film display and 3 prints supplied
 - Maximum horizontal scale : 2 mm between trace (3)
 - Maximum vertical scale : 15 cm for 1 second t.w.t (3)

- (1) An option allows amplitude and gain preservation for further optional processing in Preserved Amplitude Method (PAM Package)
- (2) Other velocity analysis combination possible
- (3) Other scaling combination available

Basic representation and display

- * Gould paper display and one copy supplied
- ** Plotter paper display and one print supplied
- *** Plotter film display and two prints supplied

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COMPAGNIE GÉNÉRALE DE GÉOPHYSIQUE

MARINE BASIC PROCESSING PACKAGE

Conventional P5 Package

Phase 1

- Demultiplexing, Editing
- True amplitude recovery (1)
- Vertical summing of adjacent records (if applicable)
- Application of individual gain recovery function
- CDP gathers
- Vaporchoc (*) signal recovery (if applicable)
- SILENE time varying deconvolution

Phase 2

- Velocity analysis with :
 - ANVIT Program every 3.600 km (2) * or
 - Constant velocity gather (CVG - 12 velocities) every 3.600 km (2) ** or
 - Constant velocity stack (VSCAN - 12 velocities) every 10.800 km (2) ***

Phase 3

- NMO corrections and first break muting
- Stack
 - May be replaced as an option by either a coherency adapted stack or a phase adjusted stack
- SILENE time varying deconvolution (optional)
- Predictive deconvolution TRITA (optional)
- Time varying filter
- Dynamic trace equalization
- Film display and 3 prints supplied
 - Maximum horizontal scale : 2 mm between trace (3)
 - Maximum vertical scale : 15 cm for 1 second t.w.t (3)

- (1) An option allows amplitude and gain preservation for further optional processing in Preserved Amplitude Method (PAM Package)
- (2) Other velocity analysis combination possible
- (3) Other scaling combination available

Basic representation and display

- * Gould paper display and one copy supplied
- ** Plotter paper display and one print supplied
- *** Plotter film display and two prints supplied

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COMPAGNIE GÉNÉRALE DE GÉOPHYSIQUE

MARINE BASIC PROCESSING PACKAGE

P6 Package

Phase 1

- Demultiplexing, Editing
- True amplitude recovery (1)
- Vertical summing of adjacent records (if applicable)
- Application of individual gain recovery function
- CDP gathers
- Vaporchoc (*) signal recovery (if applicable)
- SILENE time varying deconvolution

Phase 2

- Velocity analyses with ANVIT program *
- Each widely spaced velocity analysis generally consists of 96 traces that have been edited, muted and deconvolved.

Phase 3

- NMO corrections and first break muting
- Stack
- SILENE time varying deconvolution (optional)
- Time varying filter
- Dynamic trace equalization
- Paper display of preliminary stacked section (2) **
- Continuous velocity analyses with ANVIT program *
- Film display with 2 prints of :
 - main velocity horizons
 - interval velocity

Phase 4

- NMO corrections from continuous velocity analyses
- Stack
 - May be replaced as an option by either a coherency adapted stack or a phase adjustment stack.
- SILENE time varying deconvolution (optional)
- Predictive deconvolution TRITA (optional)
- Time varying filter
- Dynamic trace equalization
- Film display of stacked section and 3 prints supplied (2)

(1) An option allows amplitude and gain preservation for further optional processing in Preserved Amplitude Method (PAM Package)

(2) Maximum horizontal scale : 2 mm between traces
Maximum vertical scale : 15 cm for 1 second t.w.t
Other scaling combination available

* Gould paper display and one copy supplied

** Plotter paper display and one print supplied

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COMPAGNIE GÉNÉRALE DE GÉOPHYSIQUE

MARINE BASIC PROCESSING PACKAGE

WIPER Package

(Attenuation of Water Bottom Reverberations and Peg Leg Multiples)

Phase 1

- Demultiplexing, Editing
- True amplitude recovery (1)
- Vertical summing of adjacent records (if applicable)
- Application of individual gain recovery function
- CDP gathers
- Vaporchoc (*) signal recovery (if applicable)
- Time varying deconvolution

Phase 2

- Velocity analysis (after application of WIPER) with :
 - ANVIT Program every 3.600 km (2) * or
 - Constant velocity gather (CVG - 12 velocities) every 3.600 km {2} ** or
 - Constant velocity stack (VSCAN - 12 velocities) every 10.800 km {2} ***

Phase 3

- Application of WIPER multichannel dereverberation process (attenuation of water bottom and peg leg multiples)
- NMO corrections and first break muting
- Stack
 - May be replaced as an option by either a coherency adapted stack or a phase adjusted stack
- SILENE time varying deconvolution (optional)
- Predictive deconvolution TRITA (optional)
- Time varying filter
- Dynamic trace equalization
- Film display and 3 prints supplied
 - Maximum horizontal scale : 2 mm between traces (3)
 - Maximum vertical scale : 15 cm for 1 second t.w.t (3)

- (1) An option allows amplitude and gain preservation for further optional processing in Preserved Amplitude Method (PAM Package)
- (2) Other velocity analysis combination possible
- (3) Other scaling combination available

Basic representation and display

- * Gould paper display and one copy supplied
- ** Plotter paper display and one print supplied
- *** Plotter film display and two prints supplied

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COMPAGNIE GÉNÉRALE DE GÉOPHYSIQUE

MARINE BASIC PROCESSING PACKAGE

in

PRESERVED AMPLITUDE METHOD

(PAM Package)

Phase 1 (1)

- Demultiplexing, Editing
- True amplitude recovery from IFP or Binary gain
- Vertical summing of adjacent records (if applicable)
- CDP gather

Phase 2

- Amplitude decay analysis
- Analysis of the amplitude decay of selected traces and design of a master recovery function to compensate for spherical divergence and transmission losses
- Application of master recovery function

Phase 3

- Analysis and application of a function to compensate for the variation of water bottom conditions if necessary (optional)
- Vaporchoc (*) signal recovery (if applicable)
- Time varying deconvolution

Phase 4

- Velocity analyses and following sequences according to the selected marine package (P1, P2, P3, P4, P5, P6)

(1) An option allows to process and display a conventional stack in addition to the PAM section if requested prior to processing

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